

Amendments to the Specification

Page 2, the fourth full paragraph, lines 23 to 26, please amend the paragraph, as follows:

For example, JP A No. 10-196316 discloses a system configuration where air discharged from the compressor is cooled by a ~~heater~~ heat exchanger to cool the high temperature section of a turbine.

Page 3, the first full paragraph, lines 1 to 25, please amend the paragraph, as follows:

When the turbine is started, the temperature of coolant used by a ~~heater~~ heat exchanger for cooling the cooling air is low, and cooling air temperature at the ~~heater~~ heat exchanger outlet is reduced excessively, with the result that mist may occur in the cooling air downstream from the ~~heater~~ heat exchanger. If mist occurs in cooling air, dust contained in cooling air may be deposited on the wall surface of the cooling flow path. Further, if multiple dust particles are combined to big lumps of dust, a complicated and elaborately formed cooling flow path formed on the turbine high temperature section may be ~~leaked~~ blocked. Further, the auxiliary machines constituting the cooling air system may be

damaged. Especially the boost compressor constituting the system is a rotary body driven at a high speed. So if mist in air with high-speed air flow is supplied to the boost compressor, it will collide with the impeller at a high speed, with the result that the compressor may be damaged. If the boost compressor is damaged, supply of cooling air to the turbine high temperature section may be suspended, and the turbine high temperature section cooling flow path may be closed due to intrusion of foreign substances. This may cause damages.

Pages 3 and 4, the paragraph bridging these pages, from page 3, line 26 to page 4, line 10, please amend the paragraph, as follows:

Furthermore, deposition of mist on the equipment forming the cooling air system may cause rust inside the equipment. Such rust will turn into dust generated newly in the cooling air system, and will become a new factor to block the cooling air flow path. For these reasons, if such an event occurs to the cooling air system, cooling air cannot be maintained clean even if the equipment constituting the cooling air system is provided with a high-performance filter capable of separating

fine dust ~~is provided~~. Such a cooling air system is not suitable for cooling the high temperature section of the turbine.

Page 4, the fourth full paragraph, lines 23 to 25, please amend the paragraph as follows:

a ~~heater~~ heat exchanger for exchanging heat of part of air compressed by the compressor, this exchanger installed on the cooling air system; and

Pages 4 and 5, the paragraph bridging these pages, from page 4, line 26 to page 5, line 1, please amend the bridging paragraph as follows:

a system for adjusting air temperature on the downstream side of the ~~heater~~ heat exchanger in conformity to the operation time of the turbine.

Pages 6 and 7, the paragraph bridging these pages, from page 6, line 21 to page 7, line 1, please amend the bridging paragraph as follows:

According to the present embodiment, the cooling air system comprises a ~~heater~~ heat exchanger 4 for exchanging heat

of the air sent from compressor 1, a filter 5 as dust removing means for removing dust from the air the heat of which is exchanged, a boost compressor 6 for compressing air cleaned by filter 5, and a filter 7 as dust removing means for removing dust from air compressed by boost compressor 6.

Page 7, the second full paragraph, lines 6 to 17, please amend the paragraph as follows:

Compressed air branched off at the outlet of compressor 1 has its heat exchanged by the heat exchanger 4. Here heat is exchanged so that air temperature at the outlet of the boost compressor 6 on the downstream side reaches an appropriate level for cooling the high temperature section of the turbine. Air of about 500 degrees Celsius, for example, is cooled down to about 100 degrees Celsius by this ~~heater~~ heat exchanger 4. In other words, it is cooled down to the appropriate air temperature, with consideration given to rise of air temperature in the boost compressor 6.

Page 8, the second full paragraph, lines 13 to 22, please amend the paragraph as follows:

In the turbine startup period when the turbine is started by the attached starter, ignited and increased in speed, the temperature of air discharged from the compressor 1 does not increase as compared to the temperature of air sucked in the compressor 1. This air temperature is lower than that of air discharged from compressor 1 at the rated load. Accordingly, air temperature at the heater exchanger outlet is also reduced due to low air temperature at the inlet of the heater exchanger 4.

Page 8, the third full paragraph, lines 13 to 22, please amend the paragraph as follows:

In the turbine startup period when the turbine is started by the attached starter, ignited and increased in speed, the temperature of air discharged from the compressor 1 does not increase as compared to the temperature of air sucked in the compressor 1. This air temperature is lower than that of air discharged from compressor 1 at the rated load. Accordingly, air temperature at the ~~heater~~ heat exchanger outlet is also reduced due to low air temperature at the inlet of the ~~heater~~ heat exchanger 4.

Pages 8 and 9, the paragraph bridging these pages, from page 8, line 23 to page 9, line 17, please amend the bridging paragraph as follows:

In such a turbine startup period, mist may occur in cooling air downstream from the ~~heater~~ heat exchanger 4. If mist occurs in cooling air, dust in cooling air may deposit on the wall surface of the cooling air flow path formed on the high temperature section of the turbine. Then many fine dust particles contained in cooling air may be combined to form a big lump of dust. If this occurs, a complicated and elaborately formed cooling flow path formed on the turbine high temperature section may be ~~leaked~~ blocked. Blocking of the cooling air flow path may cause insufficient cooling due to insufficiency of cooling air supplied to the high temperature section of the turbine, with the result that the high temperature section of the turbine may be damaged. Further, the auxiliary machines constituting the cooling air system may be damaged. Especially the boost compressor 6 constituting the system is a rotary body driven at a high speed. So if mist in air with high-speed air flow is supplied to the boost compressor, it will collide with the impeller at a high speed. This may damage the boost compressor 6.

Page 10, the second full paragraph, lines 8 to 14, please amend the paragraph as follows:

If the aforementioned event occurs to the cooling air system, cooling air cannot be maintained clean, even if the equipment constituting the cooling air system is provided with a high-performance filter capable of separating fine dust is provided. ~~Such~~ Such an air cooling system is not suitable for cooling the high temperature section of the turbine.

Page 11, the first full paragraph, lines 4 to 8, please amend the paragraph as follows:

To ensure that the cooling air temperature will not be reduced excessively, a system is provided to adjust the air temperature downstream from the ~~heater~~ heat exchanger 4 in conformity to the turbine operation period.

Page 11, the second full paragraph, lines 9 to 24, please amend the paragraph as follows:

For example, means for heating the coolant used in the indirect type ~~heater~~ heat exchanger 4 is provided as a system for adjusting air temperature downstream from the ~~heater~~ heat

exchanger 4. Coolant used in the indirect type-~~heater~~ heat exchanger 4 is heated by the heater 8, and temperature is adjusted to the appropriate cooling air temperature, whereby preventing mist from occurring due to excessive reduction of the temperature of air at the outlet of the ~~heater~~ heat exchanger 4. The temperature of the coolant supplied to the ~~heater~~ heat exchanger 4 is controlled by the temperature of air close to the outlet of the ~~heater~~ heat exchanger 4 or on the downstream side, whereby appropriate cooling air temperature can be obtained. It is also possible to get appropriate cooling air temperature using the temperature of air discharged from the compressor 1.

Pages 11 and 12, the paragraph bridging these pages, from page 11, line 25 to page 12, line 21, please amend the bridging paragraph as follows:

However, if the turbine is started and ignition is made to increase the speed by the starter attached to the turbine, the temperature of air at the outlet (downstream side) of the compressor 1 will rise sufficiently. Even without heating coolant supplied to the ~~heater~~ heat exchanger 4 for exchanging heat of cooling air branched off from the compressor 1 to cool

the high temperature section of the turbine, air at the outlet of the ~~heater~~ heat exchanger 4 can be adjusted to the appropriate temperature as cooling air without mist occurring therein. Accordingly, by monitoring the temperature of air downstream from the ~~heater~~ heat exchanger 4 evaluation is made to see if the coolant supplied to the ~~heater~~ heat exchanger 4 must be heated or not, and adjustment can be made to reach the appropriate cooling air temperature. Alternatively, the temperature of air downstream from the compressor 1 is monitored and evaluation is made in the same manner to see if coolant must be heated or not. In this way, coolant temperature can be managed only at the appropriate time. For example, it is preferred to monitor the temperature measuring instrument for measuring the temperature of air of the cooling air system.

Pages 12 to 13, the paragraph bridging these pages, from page 12, line 22 to page 13, line 2, please amend the bridging paragraph as follows:

If temperature of air at the outlet of the compressor 1 rises subsequent to firing of turbine or increase of speed, occurrence of mist in cooling air can be reduced by

overcooling of the ~~heater~~ heat exchanger 4. Accordingly, after rise of the temperature of air at the outlet of the compressor 1, coolant is supplied to the ~~heater~~ heat exchanger 4 without being heated, and the turbine is operated.

Pages 13 to 15, the paragraph bridging these pages, from page 13, line 21 to page 15, line 16, please amend the bridging paragraph as follows:

Further, when consideration is given to the heat resistance of turbine parts constituting the collection path, especially the rotor parts, collected air temperature is preferred to be on the same level as that of the air at the outlet of the turbine compressor. To adjust the cooling air extraction temperature and collected air temperature to the same level, cooling air extracted from the turbine compressor 1 outlet must be cooled by the ~~heater~~ heat exchanger when consideration is given to possible rise of cooling air temperature resulting from cooling the high temperature section of the turbine. As described above, in the closed air cooling system, the cooling capacity of the ~~heater~~ heat exchanger is determined to ensure that air can be cooled to an appropriate temperature without any problem even during the

operation at the rated load, with consideration given to both rise of temperature by the boost compressor and rise of temperature resulting from cooling of the high temperature section of the turbine. Accordingly, a greater amount of heat can be exchanged in this system than in the ~~heater~~ heat exchanger used in the conventional cooling method wherein air after cooling is directly discharged into the main stream gas. When the turbine is started, temperature of air at the outlet of the turbine compressor 1 is lower than during operation at the rated load. The amount of heat exchanged by the ~~heater~~ heat exchanger used in the closed air cooling system is larger than in the ~~heater~~ heat exchanger used in the prior art cooling method, as described above. Cooling air temperature is unnecessarily lowered at the ~~heater~~ heat exchanger outlet. This will become a new factor for causing mist in air. Further, in the closed air cooling gas turbine, reduction of temperature of the main stream air resulting from discharge of cooling air is held down, and emission gas temperature of the gas turbine tends to become high. So in order to improve the efficiency of the gas turbine as a single body and heat resistance of the emission gas duct, it is preferred to increase the specific pressure of the gas turbine and to keep

emission gas temperature on the same level as that of the prior art gas turbine. Raising the specific pressure of the gas turbine also increases the pressure of cooling air, and the partial pressure of the steam contained in cooling air is also increased. In this sense, this will promote generation of mist. Thus, a remarkable effect in reducing the generation of mist can be expected when the present invention is applied to such a closed type system.

Page 15, the first full paragraph, lines 17 to 24, please amend the paragraph as follows:

Since the temperature of coolant used in the indirect type-~~heater~~ heat exchanger 4 is adjusted, the cooling system is indirectly controlled without direct control, and this provides a higher reliability of the cooling air system. Namely, even if coolant temperature adjusting mechanism for this-~~heater~~ heat exchanger 4 is damaged, the cooling air system itself is not seriously affected.

Pages 15 and 16, the paragraph bridging these pages, from page 15, line 27 to page 16, line 9, please amend the paragraph, as follows:

With reference to Fig. 2, the following describes an example of placing the system 9 for bypassing the ~~heater~~ heat exchanger 4. When the bypass system 9 is used, temperature of cooling air supplied to the high temperature section of the turbine is adjusted by mixing between high-temperature cooling air without using heat exchanger 4 and low-temperature cooling air at the ~~heater~~ heat exchanger outlet ~~without using heater exchanger 4~~. This prevents cooling air temperature at the outlet of the heat exchanger from lowering too much when the turbine is started.

Page 16, the first full paragraph, lines 10 to 15, please amend the paragraph, as follows:

The temperature of air at the outlet of the ~~heater~~ heat exchanger 4 is adjusted to an appropriate cooling air temperature by adjusting the flow rate of high-temperature air passing through the bypass system 9 by controlling the opening angle of a valve 9a installed in the bypass system.

Page 16, the second full paragraph, lines 16 to 23, please amend the paragraph, as follows:

If the temperature of air at the compressor 1 outlet is raised, cooling air temperature can be adjusted to an appropriate level without using the bypass system 9, by controlling the flow rate of the coolant fed to the ~~heater~~ heat exchanger 4, even when all the cooling air is fed to the ~~heater~~ heat exchanger 4. Accordingly, the valve 9a of the bypass system is totally closed.

Pages 15 and 16, the paragraph bridging these pages, from page 15, line 27 to page 16, line 9, please amend the bridging paragraph as follows:

With reference to Fig. 2, the following describes an example of placing the system 9 for bypassing the ~~heater~~ heat exchanger 4. When the bypass system 9 is used, temperature of cooling air supplied to the high temperature section of the turbine is adjusted by mixing between high-temperature cooling air and low-temperature cooling air at the heater exchanger outlet without using ~~heater~~ heat exchanger 4. This prevents cooling air temperature at the outlet of the heat exchanger from lowering when the turbine is started.

**Page 16, the first full paragraph, lines 10 to 15, please
amend the paragraph as follows:**

The temperature of air at the outlet of the ~~heater~~ heat exchanger 4 is adjusted to an appropriate cooling air temperature by adjusting the flow rate of high-temperature air passing through the bypass system 9 by controlling the opening angle of a valve 9a installed in the bypass system.

**Page, 16, the second full paragraph, lines 16 to 23, please
amend the paragraph as follows:**

If the temperature of air at the compressor 1 outlet is raised, cooling air temperature can be adjusted to an appropriate level without using the bypass system 9, by controlling the flow rate of the coolant fed to the ~~heater~~ heat exchanger 4, even when all the cooling air is fed to the ~~heater~~ heat exchanger 4. Accordingly, the valve 9a of the bypass system is totally closed.

**Page 17, the first full paragraph, lines 4 to 15, please amend
the paragraph as follows:**

In a third embodiment, an auxiliary boiler 10 is installed to heat coolant supplied to the ~~heater~~ heat

exchanger 4 when the turbine is started, as shown in Fig. 3. At the time of startup, coolant is heated when steam from the auxiliary boiler 10 is fed to the ~~heater~~ heat exchanger 11 installed on the coolant system. More appropriate temperature management can be ensured by controlling the coolant temperature using the temperature of air discharged from the compressor. To adjust this coolant temperature, the flow rate of steam from the auxiliary boiler is adjusted by the valve 11a.

Page 17, the third full paragraph, lines 19 to 25, please amend the paragraph as follows:

If the air temperature at the compressor 1 outlet is raised after turbine startup and firing, heating of coolant becomes unnecessary. So the auxiliary boiler 10 is stopped and coolant is directly fed to the ~~heater~~ heat exchanger 4. Cooling air temperature is adjusted by controlling the flow rate of coolant fed to the ~~heater~~ heat exchanger 4.

Page 18, the first full paragraph, lines 2 to 4, please amend the paragraph as follows:

In a fourth embodiment, a heater 12 is installed to heat coolant fed to the ~~heater~~ heat exchanger when the turbine is started, as shown in Fig. 4.

Page 18, the second full paragraph, lines 5 to 14, please amend the paragraph as follows:

The coolant system is provided with a water storage tank 13 which is used only when the temperature of air discharged from the compressor is low. A heater is installed on the water storage tank 13 to raise the coolant temperature. Coolant of the water storage tank 13 is fed by a feed water pump 14 to the ~~heater~~ heat exchanger 4 for cooling the cooling air from the compressor 1. Coolant temperature can be kept at an appropriate value by control of the temperature of air discharged from the compressor.

Page 18, the four full paragraph, lines 17 to 25, please amend the paragraph as follows:

After turbine startup and firing, heating by the heater 12 installed on the coolant system is suspended and valves 14a and 14b are fully closed. Valves 14c and 14d are fully opened to supply coolant directly to the ~~heater~~ heat exchanger 4,

wherein these valves 14c and 14d are connected to the feed water and drainage system from the coolant system which is shared by other equipment using coolant installed on the turbine equipment.

Page 19, the third full paragraph, lines 10 to 14, please amend the paragraph as follows:

Water coming from the feed water system 17 is turned into steam when heat of cooling air is exchanged by the evaporator 15, and is fed to the steam turbine and other equipment 18. This allows heat to collected, and plant efficiency is improved.

Page 20, the fourth full paragraph, lines 20 to 27, please amend the paragraph as follows:

If temperature of air at the outlet of the compressor 1 is raised after turbine startup and firing, heating by the heater 19 installed on the coolant system is suspended and circulation to the water storage tank is stopped. Circulating pumps 21 and 22 are stopped and valves 22a and 22b fully closed. Coolant is fed to the ~~heater~~ heat exchanger 4 directly from the coolant feed system 17.

**Page 21, the third full paragraph, lines 14 to 26, please
amend the paragraph as follows:**

After turbine startup, coolant level in the evaporator 15 is increased in conformity to the rise of temperature of air at the outlet of the compressor 1, thereby controlling air temperature. This avoids excessive decrease of temperature of air at the outlet of the evaporator at startup. At the same time, without depending on the operation status, air temperature can be kept at an appropriate level by adjusting the water level through monitoring of the temperature of air at the outlet of the compressor, temperature of air at the outlet of the ~~heater~~ heat exchanger or temperature of air at the outlet of the booster.